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**LABORATORY STUDIES IN UV AND EUV SOLAR PHYSICS**

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Annual Report  
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Principal Investigator  
W.H. Parkinson

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SMITHSONIAN INSTITUTION  
ASTROPHYSICAL OBSERVATORY  
CAMBRIDGE, MASSACHUSETTS 02138

Director: Irwin I. Shapiro

The Smithsonian Astrophysical Observatory  
is a member of the  
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The NASA Technical Officer for this grant is Dr. William J. Wagner, 075.0,  
300 E Street SW, Washington, DC 20546

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Annual Report for NAG5-9516 (6/1/01-5/31/02)

The Ion Beam Experiment at the Center for Astrophysics is dedicated to the study of ion-electron collision processes of importance in solar physics. The analysis of measurements of Electron Impact Excitation (EIE) from the  $3s3p^3P^o$  metastable state to the  $3s3p^1P$  state of  $Si^{2+}$  was completed during the past year and a paper describing the results is available as a preprint. Our current program is directed at measuring absolute cross sections for dielectronic recombination (DR) and EIE in  $Si^{3+}$ , one of the primary ions used for probing the solar transition region. Our study of DR is particularly concerned with the effects of electric and magnetic fields on the recombination rates. Measurements of silicon ions with charge greater than  $n=2$  have necessitated upgrading the experiment with a new ion source. The new source is also suitable for producing  $C^{2+}$  beams to be used for measurements of EIE and DR for that system. The source is expected to be capable of producing beams of more highly charged systems as well.

The past year has been focused on the completion of the new electron cyclotron resonance (ECR) ion source. Construction and assembly of the ion source were completed and the necessary new infrastructure (chilled water, more electrical power) has been installed and connected. Initial characterization of the ion source has been successful and is within expected parameters. The ion source has been run and has produced large currents of  $O^{(2-4)+}$  and tests with Ar produced currents of multiplied charged Ar ions. Once final testing and optimization are completed we will be in a position to measure the absolute EIE cross sections and DR rates for transitions in  $Si^{3+}$  and  $C^{2+}$  as a function of field strength.

Also this year, beam-line modifications were made which will result in higher pumping speed and lower pressure. A thorough analysis of systematic uncertainties in the photon counting electronics was completed, which will allow us to obtain better measurements of EIE and DR rates at lower photon signal rates.

Visiting scientist Dr. Adrian Daw joined graduate student Paul Janzen in the day-to-day managing and running of the Ion Beam Experiment, under the guidance of Drs. John L. Kohl and Larry Gardner. Janzen is on schedule to submit his PhD. thesis to The Harvard Physics Department in time for spring graduation.

A paper "Electron impact excitation of  $3s\ ^5S^o_2-2s^22p^4\ ^3P_{2,1,0}$  intercombination lines and of other observationally important extreme-ultraviolet lines in NeIII" has been published, (McLaughlin, B.M., Daw, A., & Bell, K.L., 2002, J. Phys. B 35,283).